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ORE DEPOSITS.

A Treatise on Ore Deposits. By J. Arthur Phillips, F.R.S. Second edition, rewritten and greatly enlarged by Henry Louis, M.A. Pp. xxii + 943. 128 illustrations, and index. (London: Macmillan and Co., 1896.)

PROFESSOR LOUIS has attempted no easy task in endeavouring to bring up to date Phillips' well-known work on ore deposits. Since the first edition appeared in 1884, mineral discoveries have been numerous and important. I need only refer to the gold of the Rand and Mount Morgan, the lead and silver of Broken Hill, the copper, silver and lead of Tasmania, the nickel of Sudbury, and the iron of Minnesota. Besides these comparatively new finds, one has to recollect the progress which has been made in developing some of the older mining districts. The years which have elapsed since 1884 have likewise been fruitful in bringing forth descriptions of ore deposits: scores of official memoirs, and hundreds of papers in the *Transactions* of scientific and technical societies at home and abroad, have been written about them; so that Prof. Louis must have had great difficulty in deciding what to ingraft upon the old stock without making his book too bulky. As it is, the second edition is half as big again as the first.

I cannot agree with Prof. Louis in excluding the minerals yielding aluminium and magnesium from the term "metalliferous ores," on the ground that by popular usage this term is applied solely to the ores of the heavy metals. We must march with the times. There was a day when hæmatite was not used for producing metallic iron; what we now call the ores of nickel and cobalt were long regarded as worthless and injurious substances. Zinc blende has only comparatively lately entered into the category of ores, and later still the carbonate of manganese. My opinion is that bauxite should rather be received with welcome into what Prof. Louis seems to consider as an aristocratic circle, than hustled out as an intruder because its metal happens to be light. After all, the ratio between the specific gravities of iron and aluminium does not differ very greatly from the ratio between the specific gravities of platinum and iron. The scientific man should rather try to lead the populace aright than cringe to misconceptions.

The book is divided into two parts: the first deals with mineral deposits generally, whilst the second is devoted to a description of the ore deposits of the various countries of the entire globe.

As several objections can be made to Phillips' classification of ore deposits, Prof. Louis very wisely abandons it; but, when he endeavours to find a substitute, he meets with many difficulties. Finally, he introduces a provisional arrangement in which origin, instead of form, is taken as the basis of the classification: giving new names to old faces, he subdivides all ore deposits into two kinds—"symphytic" and "epactic."

The former term is applied to deposits which are contemporaneous with the enclosing rocks, whilst the latter includes those which have been formed subsequently. Whether it is necessary to coin two more words with which to puzzle the unfortunate miner appears doubtful. The epactic deposits are next separated into two groups, and we eventually have three main classes, our old friends: (1) Beds; (2*a*) Veins; (2*b*) Masses.

The author of a large work dealing with all parts of the world can scarcely expect to escape some errors; nor is it easy to be quite up to date.

Prof. Louis has not corrected Phillips' erroneous description of the treatment of the lead-bearing sandstone at Mechernich, Rhenish Prussia. The book says that the little nodules of galena are separated below ground, and alone are sent to the surface, whilst the waste sand left behind is employed for filling the exhausted workings. As a matter of fact the nodules are extracted by a true dressing process above ground, more particularly by the aid of a special concentrator—the "Heberwäsche."

Phillips has likewise led Prof. Louis into error by saying that the Freiberg School of Mines was founded in 1702. The first project for the School was made at the end of 1765, and the lectures began at Easter 1766.

Following my usual custom, I cannot help tilting at the employment of unnecessary provincial terms in books upon mining. If "flucan" simply means "clay," why not stick to the word understood by all English-speaking persons, and consign to oblivion the Cornish term, which serves no useful purpose? On the other hand, if a provincialism is to be adopted on account of its brevity or general convenience, it should not be altered. I refer, as I have often done before, to the expression "country rock." By "country" the Cornishman means "surrounding rock"; to say "country rock" is tautology. Further, is it advisable to introduce into technical literature such a term as "lode formation," in the sense in which it is employed by ignorant persons or unthinking mining engineers? In the first place, the term "formation," as applied to lodes, already has a definite meaning attached to it. It denotes a group of mineral veins having certain characteristics, leading one to believe that they have a common origin. The so-called "lode formations" of Western Australia are veins of a special kind which can be described without bringing in the puzzling word "formation." The introduction of any new terms should be scrutinised by writers with the greatest jealousy, for the science of ore deposits is quite obscure enough already without being further darkened by a vague terminology.

Following Phillips, Prof. Louis retains the word "huel" in speaking of various Cornish mines, though the mining companies invariably write the word "wheal." Even if one admits that "huel" may be the more correct spelling, it is far too late now to think of enforcing it. It is not convenient for the student to have the name of a mine, "Wheal Mary Ann," for instance, inserted under the letter "h" instead of the letter "w," as he may be quite ignorant of the old way of writing the word.

Slight errors in the spelling of names of persons and places are a little too common. It may be hoped that the prefix "Sir" to Dr. Selwyn's name is simply the shadow of a coming event, and that it will cease to be a mistake long before the present edition is exhausted.

With regard to his own country, Prof. Louis is a little behind the times. He says that mining is "extensively"

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carried on in Anglesey and in the south-west of Ireland. Taking the official statistics for 1895, one finds that only thirteen persons were employed underground in Anglesey, and thirty-two in the county of Cork. These figures scarcely justify the adverb used by Prof. Louis. Herodsfoot mine is spoken of as if it were still at work, though it was abandoned fully ten years ago; in fact, Cornwall has ceased for some time to be a lead-producing county.

No doubt it is easier to pick a few holes in a work of this kind than to write it, and it must not be supposed from my criticisms that I in any way undervalue the great amount of care and labour which Prof. Louis has bestowed upon his work. The new book is a very valuable addition to technical literature, in spite of the want of a sufficient number of plates, which was likewise a fault of the first edition; possibly Prof. Louis may have had to bow to restrictions imposed upon him by his publishers. In any future edition it would be better to sacrifice some of the letterpress, if by so doing more figures could be introduced. C. L. N. F.

THE RESISTANCE OF THE AIR.

Experiments made with the Bashforth Chronograph to find the Resistance of the Air to the Motion of Projectiles. By Francis Bashforth, B.D. (Cambridge: at the University Press, 1895.)

IF Mr. Bashforth could have struck a bargain with the Government similar to that made by James Watt with the Cornish miners, his royalties on the gunpowder saved annually by the use of his Ballistic Tables would have rivalled the claims contested in some recent lawsuits.

By a few well-designed experiments with his Electro-Ballistic Chronograph, initiated now more than thirty years ago, when he took up the appointment of Professor of Mathematics to the Advanced Class of Artillery Officers, he was able to determine the resistance of the air at all useful velocities to the projectiles fired from the muzzle-loading guns then in vogue, to which a return had been made by our military authorities.

In accordance with the proverb—*Ὅτι οὐκ ἔστι προφήτης ἄτιμος, εἰ μὴ ἐν τῇ πατρίδι αὐτοῦ, καὶ ἐν τοῖς συγγενέσι καὶ ἐν τῇ οἰκίᾳ αὐτοῦ*—these experiments attracted great attention in naval and continental expert circles, everywhere except at Woolwich; they still remain to this day the only actual determinations of the Resistance of the Air with which we have to work in Artillery; and the Ballistic Tables of Mr. Bashforth, based upon these experiments, are to be found in all naval and foreign treatises on the Theory of Artillery.

When the Bashforth Chronograph revealed the unsteadiness of shooting of our guns, the manufacturers of ammunition and guns felt insulted, and wanted to throw the blame on the imperfections of the instrument, as if their manufactures were not absolutely perfect; now, however, in recent Range Tables, the manufacturers have to submit to the indignity of 50 per cent. zones, showing the degree of scattering of their weapon at the various ranges.

Although the breech-loading system has been finally adopted, and although the experimental side of Electricity may be said to have been re-created since Mr. Bashforth began to experiment, sc far no new experiments have been carried out or sanctioned for finding the modification of the Resistance of the Air due to changes of shape in modern projectiles, and to the superior steadiness in flight obtainable with the breech-loading system.

Gunpowder, or cordite, costing annually many thousands of pounds, is blazed away at proof, merely to inspect brands of powder by determining a muzzle velocity, by shooting between two electric screens. If only one more screen, but the more the better, could be introduced, much useful information could be gained at the same time of the Resistance of the Air.

The Boulengé Chronograph, employed at proof, is not adapted for more than two screens; but superior Chronographs are now in the field, with which it is possible to read any number of screen records.

Every new Chronograph claims to record at least a millionth of a second; but Mr. Bashforth did not attempt to go behind the fourth decimal, knowing that the accuracy of any experiment is only that of its most inaccurate part; in this case the screens, in which the breaking of a wire might take place within the limits of a foot, according to the manner in which the wire is struck by the head or shoulder of the projectile; this alone is sufficient to account for a discrepancy enough to render the fourth decimal almost nugatory.

By averaging the results, however, of as many rounds as possible, Mr. Bashforth has arrived at the normal Resistance of the Air, from which individual shots may vary as much as 10 per cent. or more; and allowing for difference of shape, smoothness, and steadiness of projectile, the continental experiments of Krupp and others amply confirm Mr. Bashforth's results.

Inflation in the manufacture of warlike stores is at the present moment unprecedented; and yet very little careful examination takes place, of what improvements are possible as the result of scientific inquiry, carried out leisurely on a small scale. Our ministers vote millions for warlike stores, and still, as in the days of General Peel's report, they scrutinise with the greatest care a small vote, technically called ineffective, which serves to prevent these millions from being money thrown away.

Provided with Bashforth's Tables, and a knowledge of how to use them, which need not appreciably alter his weight or the height of his centre of gravity in the saddle, the artillery officer of the future might dispense with half the useless weight of ammunition he drags about in the field; or, at least, the same weight might be refashioned for a heavier gun, employing curved fire.

The superior ballistic coefficient of the larger projectile soon enables it to overtake the puny projectile of the rival pop-gun; but to secure these advantages, good range-finding is an indispensable accessory; the weight of the most efficient range-finder need not, however, exceed that of a single round, which might otherwise be expended as a trial shot.

Mr. Bashforth writes occasionally with bitterness; but he has been the victim of our curious official scientific etiquette, which disparages a new idea when submitted, and afterwards appropriates the results without acknowledgment when the idea has proved a success.

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